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Recaptures of Atlantic Salmon Tagged and Released in the Bay of Fundy near the Saint John River, New Brunswick, 1970-73

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ABSTRACT

Penney, G.H. 1983. Recaptures of Atlantic salmon tagged and released in the Bay of Fundy near the Saint John River, New Brunswick, 1970-73. Can. MS Rep. Fish. Aquat. Sci. No. 1737. vii + 12 p.

Drift-net fishing in the Bay of Fundy near the Saint John River, New Brunswick, resulted in the tagging and release of 1,897 wild Atlantic salmon (Salmo salar) between May 30 and August 7, 1970-73. In total, 876 (46.2%) were recaptured. Only three of the tagged salmon were reported captured commercially outside the Saint John River area during the years they were tagged. In 1973, 69.9% of the total recaptures at the Nashwaak River fence were taken on or after September 1. The average time interval from release to recapture of these fish was 90.0 days.

Key words: Atlantic salmon, tagging, tag recovery, time interval, Bay of Fundy, Saint John River, drift net fishing, counting fence, angling recoveries, commercial fishing recoveries.

RÉSUMÉ

Penney, G.H. 1983. Recaptures of Atlantic salmon tagged and released in the Bay of Fundy near the Saint John River, New Brunswick, 1970-73. Can. MS Rep. Fish. Aquat. Sci. No. 1737. vii + 12 p.

Entre le 30 mai et le 7 août 1970-73, 1 897 saumons atlantiques (Salmo salar) sauvages capturés dans la pêcherie aux filets maillants dans la baie de Fundy, près de Saint-Jean, au Nouveau-Brunswick, ont été marqués et remis en liberté. En tout, 876 poissons ont été recapturés (46,2%). Seulement trois des saumons maruqés ont été recapturés par des engins commerciaux hors de la zone de la rivière Saint-Jean dans l'année du marquage. En 1973, 69,9% des recaptures totales au barrage de comptage de la rivière Nashwaak ont eu lieu le ou après le 1er septembre. L'intervalle de temps moyen entre le marquage et la recapture de ces poissons a été de 90,0 jours.

INTRODUCTION

During the years 1970-73, the Fisheries Research Branch, through a charter-boat arrangement, drift-netted, tagged and released 1-SW (grilse) and 2-SW and older fish (salmon) in the Bay of Fundy within a 16-km radius of the mouth of the Saint John Harbour (Fig. 1). The tagging program was designed to provide data on their distribution in the Bay of Fundy area, on commercial and angling exploitation rates and on migration times to various locations within the Saint John River system.

METHODS AND MATERIALS

FISHING/TAGGING EFFORT AND NETS USED

Drift-net fishing was done under contract by two experienced fishermen operating out of Lorneville (Fig. 1). They provided a 9.6-m boat, their fishing skills and assistance in handling and tagging fish. Netting and tagging was generally carried out in June and July for 8-12 hours a day, Monday to Friday, ceasing only when wind velocities exceeded 24 km/hr. In both 1970 and 1971, a commercial salmon drift-net fishery operated on 2-SW and older fish in the tagging and release area.

Individual nets used during the 1970-73 period were provided by the Department of Fisheries and Oceans and varied in size (stretched-mesh measure) from 114 to 165 mm (4.5-6.5 in.). The 114-mm mesh was used to capture 1-SW fish, while mesh sizes from 152 to 165 mm were used to capture 2-SW and older fish. Nets ranged in length from 70 to 150 fathoms each (420-900 feet) and were a standard 25 meshes deep. Different combinations of net sizes were joined and placed on a power-drum located on the stern of the boat (Table 1). A "gang" of from 5 to 9 individuals gillnets, ranging in total length from 550 to 1,200 fathoms (3,300-7,200 feet), was released over the stern of the boat and drifted northeasterly on a flood tide and southwesterly on an ebb tide.

METHODS OF TAGGING

Nets were constantly patrolled. When a fish was sighted, it was retrieved by using a gaff to lift the net section in which the fish was entangled into the boat. Fish were quickly removed from the net and placed in an on-board 225-litre (50-gallon) recovery tank containing continuously circulated fresh sea water. After recovering from the effects of netting, fish that were deemed to be in a suitable condition were tagged. Both tagged and untagged (weak and unsuitable) fish were released at a distance from the nets which would minimize the probability of immediate recapture.

Fish were categorized as salmon or grilse of either wild or hatchery origin. Wild fish were those that originated from natural spawning and hatchery fish were returns from hatchery smolt releases. Hatchery returns were identified by their absence of an adipose fin or other identification marks applied before being released as smolts from the hatchery.

For application of tags, fish were removed from the recovery tank and placed in a water-filled plywood box, fitted with a rubber head shield to calm the fish. The tagging box was 122 x 31 x 23 cm (48 x 12.2 x 9 in.) and was divided lengthwise by a partition supporting a metre-stick used in measuring fish length. Fish were placed between the partition and one side of the box to prevent excessive movement while being tagged. In 1970, either white or yellow, modified Carlin tags (30 x 10 mm) were used; in 1971, yellow, Floy, T-bar, tube-type tags (75 mm long) were used. The tube was attached to a piece of plastic with a T-shaped end which secured the tag when injected into the fish with a tagging gun. Tags used in 1972 and in 1973 were modified Carlin tags 5 x 15 mm and blue in color. Carlin tags were attached to the fish with stainless steel wire. All tags were attached to the fish at the base of the dorsal fin and were marked with a serial number and the Department's return address. To encourage cooperation from fishermen, a $3.00 reward was paid for each tag returned.

TABLE 1. Summary of numbers and sizes of drift nets used each year, 1970-73.

Net specifications	1970	1971	1972	1973
Length (fathoms) of individual nets	150	100-150	70-90	70-90
Mesh sizes (mm)				
Salmon	152	152-165	152	152-159
Grilse	-	114	114	114
Number of nets in "gang"	8	5-8	7	7-9
Length (fathoms) of "gang"	1,200	750-1,000	550-590	590-790
Percent of "gang" consisting of 114-mm mesh	0	16% Jul 5-13 35% Jul 14-26	16% Jul 1-27	12% Jun 16-Aug 7

RECAPTURE FACILITIES AND DATES OF OPERATION

Sources of tag-return information included the Bay of Fundy and Saint John River commercial fishermen, anglers and Fisheries Research Branch salmon-trapping facilities. Fisheries Research Branch facilities were located (Fig. 1) in Big Salmon River (Fishery Statistical District 48), the Saint John River at Long Reach (District 55), Salmon River (District 56), Nashwaak River (District 58) and at Mactaquac Dam (District 58).

The normal commercial season extended from May 15 to August 15, Monday through Friday inclusive. However, in both 1970 and 1971, there was a two-week closure in June. Angling recoveries during each of the years 1970-73 could occur between May 15 and October 15. During the tagging program, Fisheries Research Branch salmon-trapping facilities on the Big Salmon River operated from mid- or late May to about the end of October. Trapping facilities at two locations in Long Reach operated in 1970 and 1971 as commercial stands from May 15 to August 15 and as government traps from August 16 to the end of October. In 1972 and 1973, the Long Reach traps fished from mid-May or early June to early in November. The Salmon River (District 56) counting trap operated only from August 29 to November 9, 1970. The Nashwaak River counting trap operated between August 18 and October 29, 1972, and from June 13 to November 5, 1973. Mactaquac salmon-trapping facilities were in operation each year during 1970-73 from about mid-May to mid-November. Fisheries Research Branch trapping and release facilities usually operated seven days per week.

RESULTS

FISHING PERIODS, CATCHES AND TAGGED RELEASES

Yearly (1970-73) fishing periods, catches of salmon and grilse, fishing mortalities and numbers of fish tagged and released are summarized in Table 2. Fishing was generally carried out during June and July. Catches of salmon averaged 521 each year for the 1970-73 period and varied from 217 to 707. Grilse catches were substantially lower, averaging only 52 each year for the 1971-73 period. None of the nets used in 1970 were of mesh size normally used to catch grilse and only 12%-35% of the net "gangs" consisted of grilse mesh in 1971-73 (Table 1). Catches of salmon and grilse in 5-day intervals are listed in Table 3. Salmon catches began in late May or early June and tapered off in late July or early August. Grilse catches, however, occurred mostly in July. Fishing mortalities (Table 2) averaged 6.7% of the salmon and 7.0% of the grilse catch. Numbers of tagged salmon and grilse released in a year ranged from 210 to 662 for the former and from 23 to 69 for the latter. Adult returns of hatchery origin represented only 3.2% of the tagged salmon and 3.5% of the tagged grilse released during the 1971-73 period.

RECAPTURES OF TAGGED FISH

Recaptures of tagged fish by different methods and at various locations for each year (1970-73) are summarized in Table 4. Recaptures include only those fish recovered up to December 31 in the year of

TABLE 2. Yearly (1970-73) fishing periods, catches, mortalities and numbers of fish tagged and released.

	1970	1971	1972	1973
Fishing period	Jun 1-Jul 29	Jun 1-Jul 26	May 30-Jul 27	May 31-Aug 7
Number untagged fish caught				
Salmon	498	217	662	707
Grilse	1	26	69	60
Fishing mortalities				
Number of salmon	46	7	41	45
Percent of total caught	9.2	3.2	6.2	6.4
Number of grilse	0	3	0	8
Percent of total caught	-	11.5	-	13.3
Number of fish tagged and released				
Salmon	452	210	621	662
Grilse	1	23	69	52

Includes 1, 11 and 36 hatchery salmon, 1971-73, respectively.
Includes 2, 1 and 2 hatchery grilse, 1971-73, respectively.

TABLE 3. Yearly (1970-73) catches of salmon and grilse in 5-day intervals.

Period	Salmon				Grilse			
	1970	1971	1972	1973	1970	1971	1972	1973
May 30-Jun 3	9	13	14	2				
Jun 4-8	17	22	36	22				
Jun 9-13	78	54	21	22				
Jun 14-18	282	50	9	39				
Jun 19-23	32	17	72	66	1			
Jun 24-28	15	6	72	30				2
Jun 29-Jul 3	19	19	19	84			1	3
Jul 4-8	9	26	82	78		18	16	6
Jul 9-13	15	9	152	101		5	17	15
Jul 14-18	10	1	94	103		0	11	17
Jul 19-23	11	0	33	64		0	8	6
Jul 24-28	0	0	58	69		3	16	5
Jul 29-Aug 2	1			11				3
Aug 3-7				16				3
Totals	498	217	662	707	1	26	69	60

TABLE 4. Numbers of salmon and grilse recaptured in each year (1970-73) of tagging.

Method and location	Salmon				Grilse			
	1970	1971	1972	1973	1970	1971	1972	1973
Commercial fisheries	188	63	1	2	1	0	0	0
Angling fisheries	16	2	13	12	0	0	0	1
Fisheries Research Branch traps:								
Big Salmon River	0	0	1	0	0	0	2	0
Long Reach	7	0	37	40	0	0	3	0
Salmon River	3	-	-	-	0	-	-	-
Nashwaak River	-	-	50	94	-	-	3	2
Mactaquac	42	34	156	130	0	1	5	7
Miscellaneous	1	0	0	0	0	0	0	0
Total recaptures	257	99	258	278	1	1	13	10
Percent of total tagged & released	56.9	47.1	41.5	42.0	100	4.3	18.8	19.2

Found dead (District 58).
Includes 6 and 10 hatchery salmon in 1972 and 1973, respectively.
Includes 1 and 1 hatchery grilse in 1971 and 1972, respectively.

tagging. Fish recovered commercially or by angling are excluded from Fisheries Research Branch trap totals even though they may have been previously recaptured in these traps. Fish recaptured in the Long Reach traps and subsequently recaptured in upstream traps are included only in the totals for the farthest upstream recapture location to avoid double-counting.

During the 1970-73 period, the proportions of tagged older salmon that were recaptured averaged 46.8%; while grilse recaptures averaged 14.1% during 1971-73.

Prior to the closure of the commercial salmon fishery in 1972, commercially caught tag returns in 1970 and in 1971 accounted for 73.2% and 63.6%, respectively, of the total salmon recaptures. In the absence of commercial salmon fishing, Fisheries Research Branch traps in 1972 and in 1973 accounted for 94.6% and 95.0%, respectively, of total salmon recaptures. Commercial fisheries recaptures of salmon shown for 1972 and 1973 consist of incidental by-catches reported from sturgeon and herring fisheries, respectively. There were no tags

returned from incidental catches of salmon in 1970 or in 1971 by other-species fisheries. Tags returned by anglers accounted for 4.8% of the total salmon recaptures over the 1970-73 period. Table 5 lists the numbers of salmon recaptured by commercial and angling fisheries in the various Fisheries Statistical Districts (Fig. 1). When the commercial salmon fishery was open in 1970 and 1971, 87.2% and 60.3%, respectively, of the total salmon tags returned from commercial salmon fisheries were from Districts 48 and 49 combined.

During 1970-73, 83.7% of the total angling recaptures of salmon were reported to be from District 58. The Nashwaak River accounted for 80.6% of the District 58 salmon tags returned by anglers.

TIMING FROM TAGGING TO RECAPTURE

The elapsed time, in days, from tagging and release of wild salmon in the Bay of Fundy to recapture in Fisheries Research Branch traps at Long Reach, 1972-73; the Nashwaak River, 1973; and at Mactaquac, 1972-73; are listed in Table 6. To exclude any effects of multiple recaptures on migration times, only first-time recaptures were used to determine timing from tagging and release to recapture.

TABLE 5. Numbers of commercial and angling recaptures of salmon by fisheries statistical districts in each year (1970-73) of tagging.

Statistical district no.	1970	1971	1972	1973
Commercial recaptures				
40	0	1	0	0
48 + 49	164	38	0	0
50	0	0	0	1
51	0	0	0	1
55	16	18	1	0
56	2	1	0	0
57	1	1	0	0
58	5	2	0	0
Unknown	0	2	0	0
Total	188	63	1	2
Angling recaptures				
48	0	0	1	0
55	0	0	2	1
56	2	0	0	0
58	13	2	10	11
Unknown	1	0	0	0
Total	16	2	13	12
Nashwaak River	10	1	8	10
Keswick River	1	0	0	0
Unknown location	2	1	2	1

TABLE 6. Days from tagging to recapture of wild salmon at Long Reach, Nashwaak River and Mactaquac.

Location and year	No. of recaptures	% of total	Minimum no. of days	Maximum no. of days	Mean no. of days	SD
Long Reach, 1972						
For the year	48	-	5	68	38	16.8
Before Sep 1	37	77.1	5	64	33	15.3
Sep 1 and later	11	22.9	43	68	55	7.4
Long Reach, 1973						
For the year	54	-	14	90	43	15.1
Before Sep 1	35	64.8	14	60	37	12.8
Sep 1 and later	19	35.2	32	90	55	11.8
Nashwaak River, 1973						
For the year	73	-	19	128	72	32.4
Before Sep 1	22	30.1	19	59	32	11.4
Sep 1 and later	51	69.9	51	128	90	20.4
Mactaquac, 1972						
For the year	135	-	16	115	57	24.2
Before Sep 1	74	54.8	16	92	40	13.6
Sep 1 and later	61	45.2	42	115	78	16.8
Mactaquac, 1973						
For the year	101	-	16	131	63	26.5
Before Sep 1	38	37.6	16	74	35	12.2
Sep 1 and later	63	62.4	45	131	80	16.4

The mean recapture times combined at the Long Reach trap sites, 17 and 18.5 km upstream from Saint John, were 38 and 43 days in 1972 and 1973, respectively. At Long Reach, 23% of the total recaptures were taken on September 1 or later in 1972, compared to 35% during the same period in 1973. At the Nashwaak trap, located approximately 21 km upstream from the mouth of the Nashwaak River or 140 km upriver of Saint John, the mean recapture time was 72 days in 1973; 70% of these recaptures were taken on September 1 or later. Recapture times at Mactaquac, 137 km above Saint John, averaged 57 and 63 days in 1972 and 1973, respectively. In 1972, 45% of the total recaptures at Mactaquac were taken on September 1 or later, compared to 62% taken during the same period in 1973.

The times in days from tagging and release to recapture (Table 6) are illustrated for individual fish in Figs. 2-6. An oblique line on each figure is the locus of points on which the x-axis is equal to the y-axis. Distance vertically above the oblique line represents the number of days from tagged fish release to subsequent recapture.

Mactaquac recaptures in each year (Figs. 5 and 6) appear to be represented by one group of fish that moved upstream as a unit and were recaptured well before September 1, and a second group which moved upstream much more slowly and were recaptured mainly from mid-September to early October.

DISCUSSION

Experimental fishing and tagging operations during 1970-73 were generally carried out in June and July in an area (Fig. 1) between Point Lepreau and Cape Spencer, and extending seaward for about 16 km, to coincide with the timing and location of traditional salmon drift-net fisheries in the area. Huntsman (1931) outlines the Bay of Fundy salmon drift-net fishery as being located along the coast in the Saint John area and extending westward to Point Lepreau and beyond. Smith (1969) describes the fishery as usually operating in an area from 16 to 19 km offshore and extending from Cape Spencer to the vicinity of Point Lepreau.

Numbers of 2-SW and older salmon caught each year varied from 217 to 707, with catches being dependent on fish abundance, suitability of tides and weather for fishing, and on fishing effort. Until the commercial ban began in 1972, salmon catches were also influenced by competition between the tagging and commercial boats. Large-salmon catches generally peaked between mid-June and mid-July, while grilse were most evident during the month of July. Smith (1969) explains that fishermen believed insufficient numbers of salmon were present to justify significant fishing effort until late May or early June.

Average fishing mortalities (1970-73) of 6.7% of the salmon and 7.0% of the grilse catch occurred when fish became badly entangled in the nets. Such mortalities usually occurred during windy conditions, or when tides pulling in two different directions tightened the nets, or when changing of the tides would cause nets to bunch together in irregular shapes.

Substantial home-water commercial exploitation of Saint John River salmon stocks is indicated by the proportions of tagged salmon catches reported by commercial fishermen. They accounted for 73.2% and 63.6% of the total tagged salmon recoveries in 1970 and 1971, respectively. Smith (1969) estimated yearly exploitation rates by home-water commercial salmon fishermen to vary from 50% to 90% of the salmon. During the closure of the commercial salmon fishery, proportions of tagged salmon recovered at Mactaquac increased to 58% (1972) and 47% (1973), from 16% in 1970 and 34% in 1971 when the commercial salmon fishery was open. Tags returned by anglers accounted for 5% of the total tagged salmon recaptures from 1970-73.

Only one tagged salmon and two tagged grilse were recovered in the Fisheries Research Branch counting-fence trap in Big Salmon River. Smith (1969) reported that of 189 salmon tagged and released from the commercial salmon drift nets in the Bay of Fundy in 1962 and 1963, only two were recaptured in Big Salmon River in the year of tagging. Jessop (1976) concluded that Big Salmon River salmon contributed very little to the extensive salmon drift-net fishery off the mouth of the Saint John River, since only two tagged Big Salmon River fish have been reported from this fishery.

From 1970 to 1973, only three tagged salmon were reported caught commercially outside the Saint John River area during the year tagged. One, in District 40, was in a commercial salmon trap and those listed for Districts 50 and 51 were reported caught in herring weirs. The one salmon angling recapture listed for District 48 was reported caught in Black River. Smith (1969) stated that the Bay of Fundy salmon drift-net fishery catches salmon that are primarily of Saint John River origin, but that some contribution may be made by other nearby rivers. Hunstman (1931) concluded that the salmon taken in the drift-net fishery that operates westward along the coast from the mouth of the Saint John River really belong to that river. He describes the Saint John River as dominating southern and western New Brunswick, and as a result the Saint John River salmon are the principal ones for the northwest coast of the Bay of Fundy.

Most of the salmon tags returned from the commercial fishery were from fish reported caught in Fisheries Statistical Districts 48 and 49. These Districts combined provided 87% and 60% of the total commercial returns in 1970 and 1971,

respectively. The inland Saint John River Districts 55-58 accounted for 13% in 1970 and 38% in 1971 of the total commercial returns. Smith (1969) reported that the inland fishery catches an average of 17% of the combined total Bay of Fundy, Saint John Harbour and Saint John River salmon catch, and that the inland portion of the catch has varied from 9% to 36% yearly.

Of the wild salmon tagged and released between May 30 and August 7, the proportions recaptured before and after September 1 varied from year to year at the same recovery site and within the same year between recovery sites. The Nashwaak River recovery site showed the highest proportion (70%) of recaptures occurring on September 1 or later, and the highest average number of days (72) from tagging and release to recapture. Elson (1974) classified as early-run, those fish that ascended by August 31 a counting fence located about 11 km above the head of tide on the Northwest Miramichi River. He classified those entering the counting trap from September 1 onward as late-run fish. Brawn (1982) concluded from visual and ultrasonic tracking of tagged fish that late-run fish can be in a river estuary as early as June and that they may delay their upstream migration for as much as three and one-half months.

ACKNOWLEDGEMENTS

Fisheries Research Branch biologists, K.E.H. Smith and C.E. Wykes planned and directed the tagging and recapture program. Jack Ingram, Fisheries Research Branch technician, organized logistic support and supervised field operations. Harry McCavour and Clarence MaGuire, owners and operators of the tagging boat, provided invaluable fishing knowledge and experience. Other Fisheries Research Branch personnel also contributed as follows: Technician Wayne Penney recorded and assisted in the compilation of field data, technician Phil Gallop drafted earlier versions of the figures and constructive review of the report was provided by biologist Dr. T.L. Marshall.

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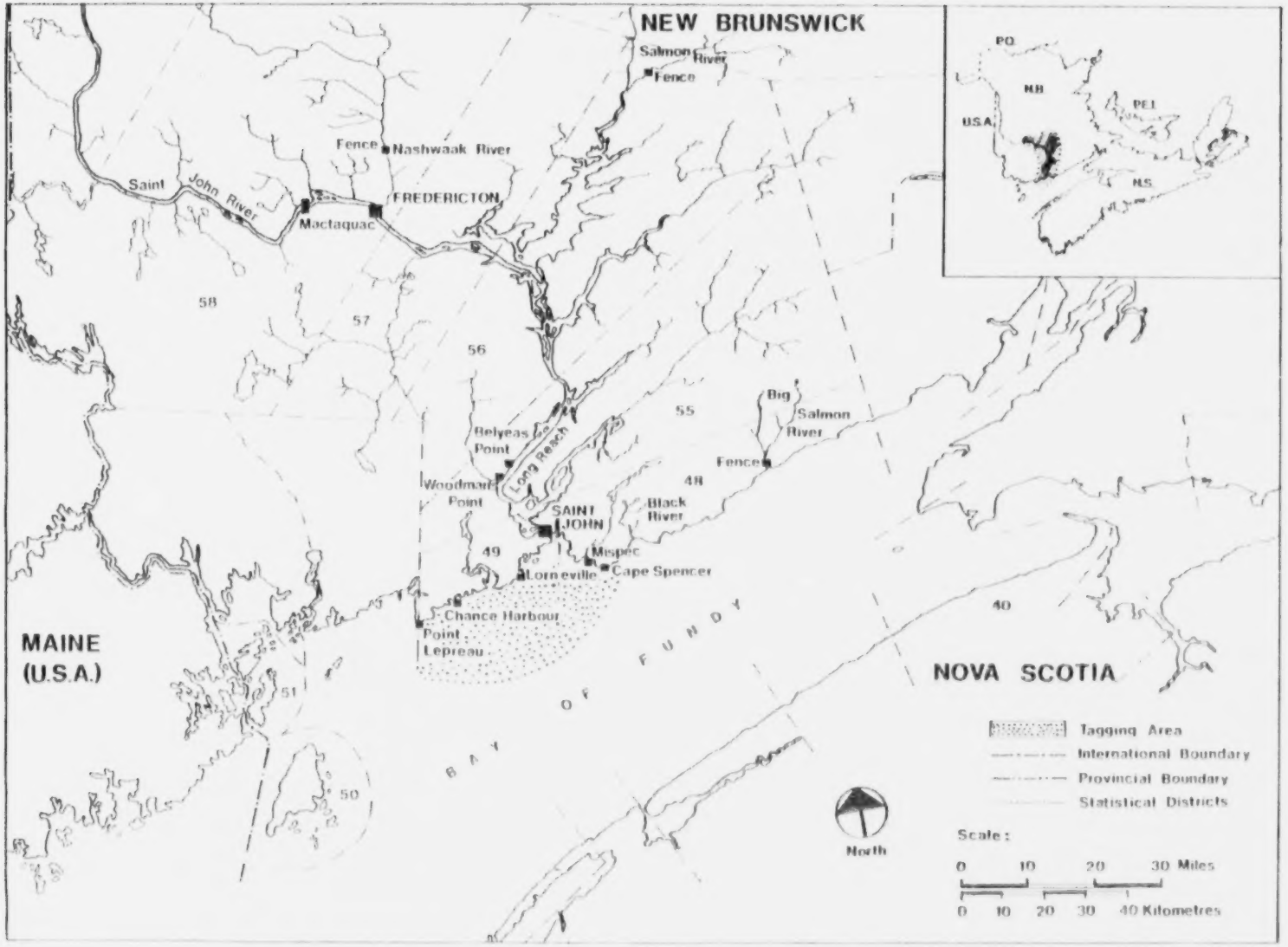

FIG 1. Bay of Fundy and Saint John River system, showing drift-net tagging area and tag recapture locations.

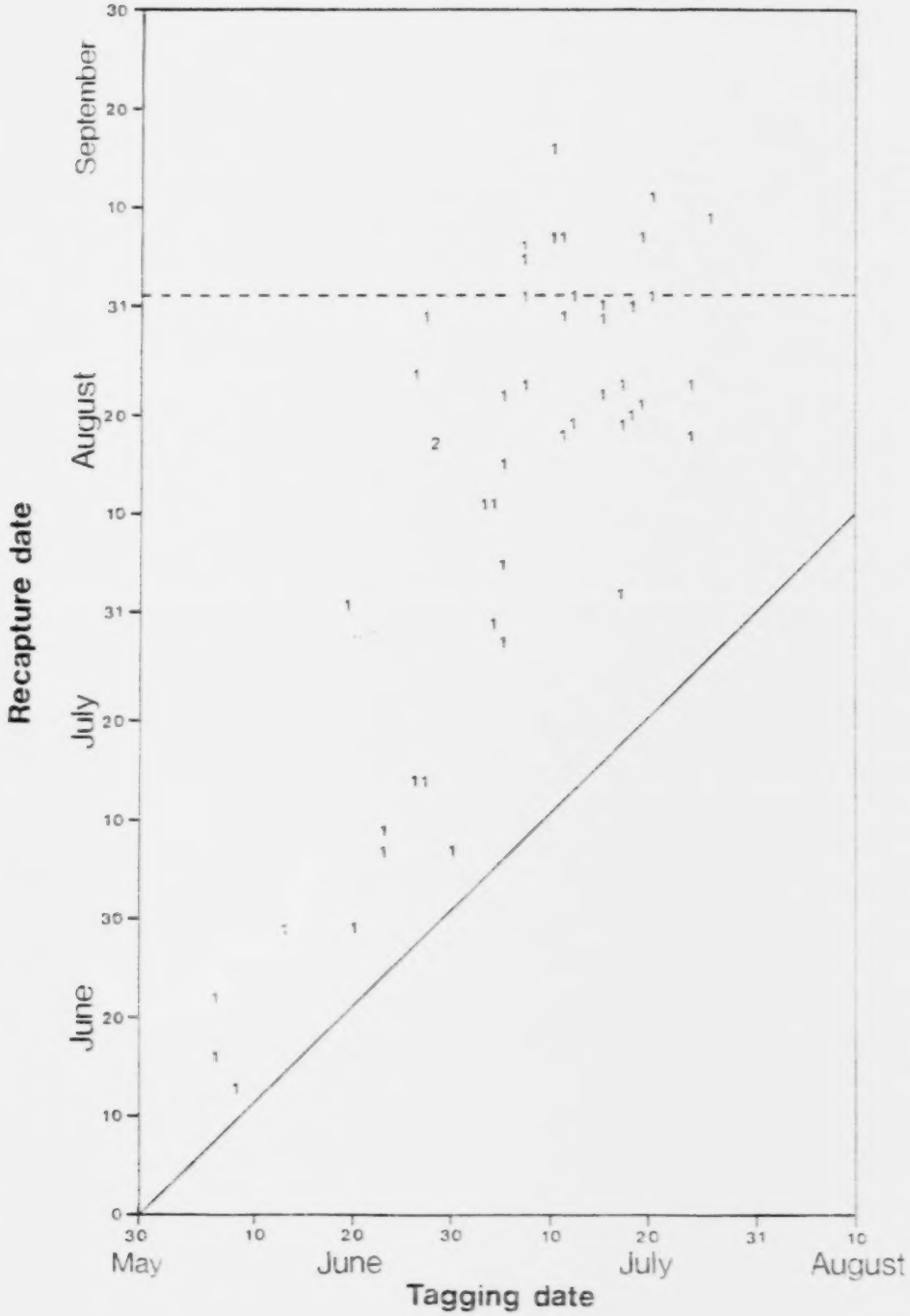

FIG. 2. Days from tagging to recapture of wild salmon before and after September 1 at Long Reach in 1972.

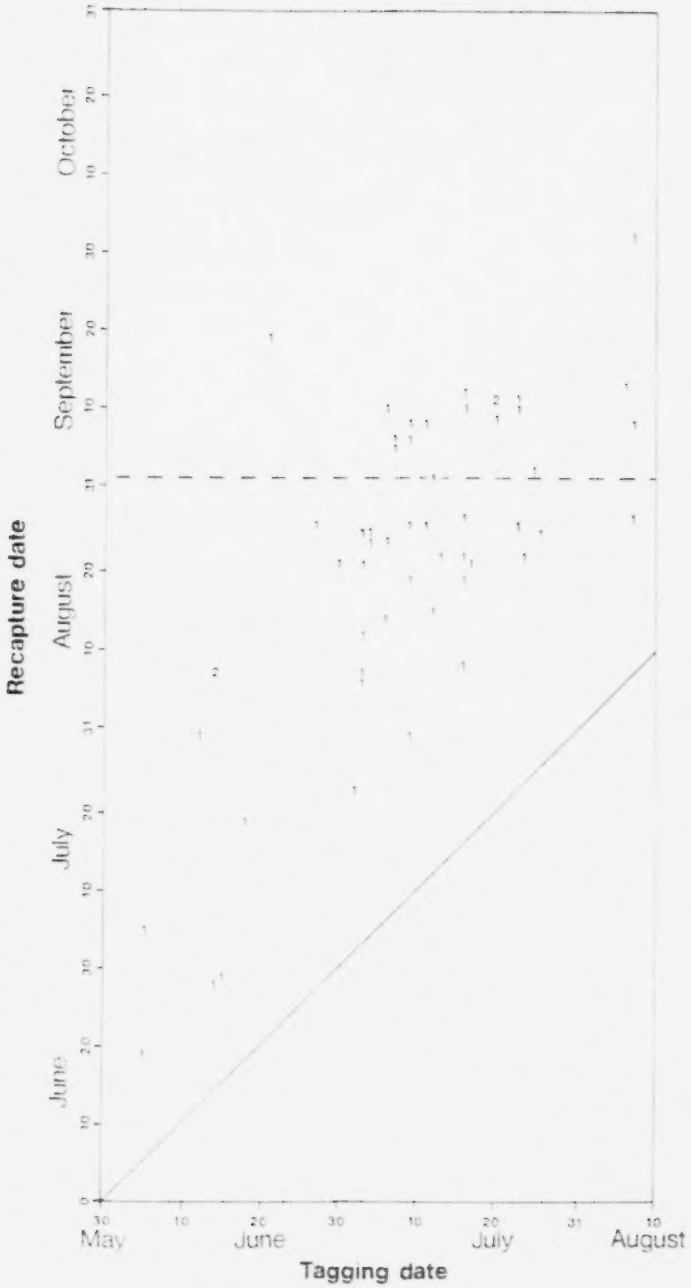

FIG. 3. Days from tagging to recapture of wild salmon before and after September 1 at Long Reach in 1973.

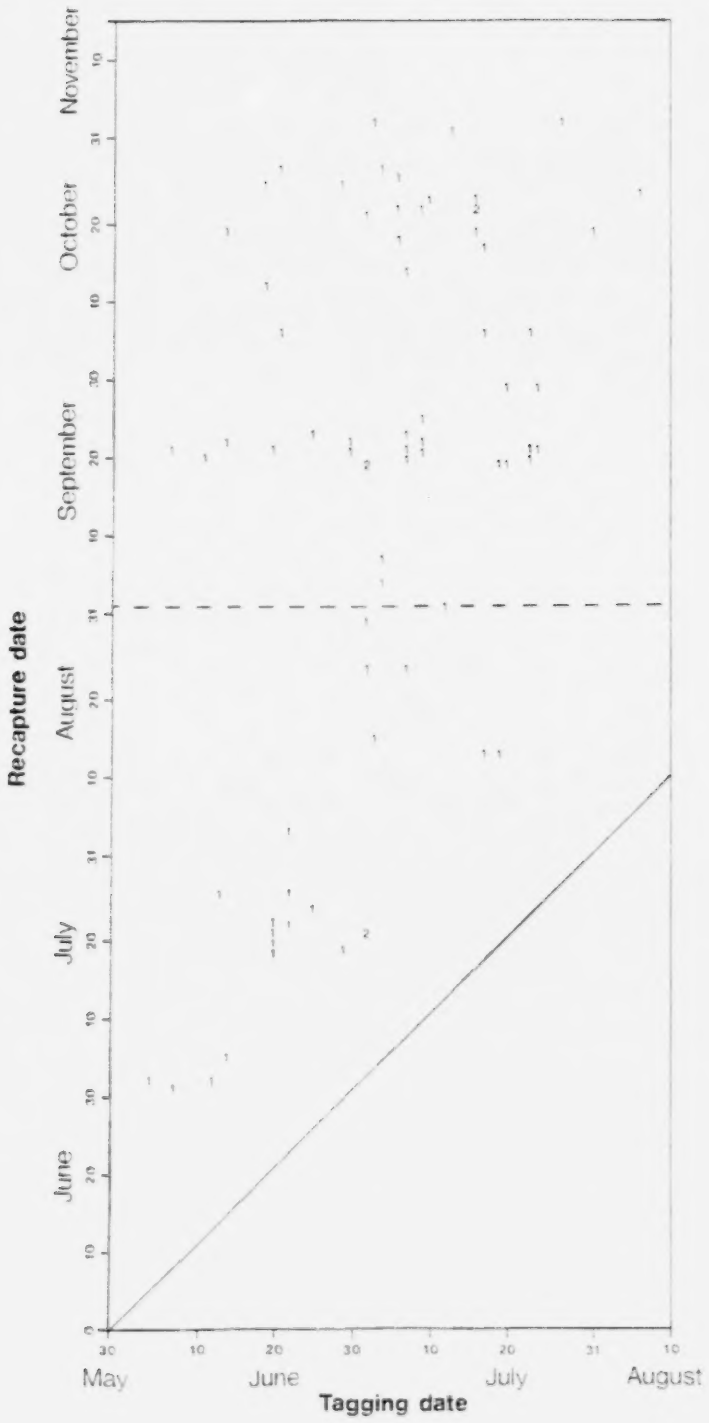

FIG. 4. Days from tagging to recapture of wild salmon before and after September 1 in the Nashwaak River in 1973.

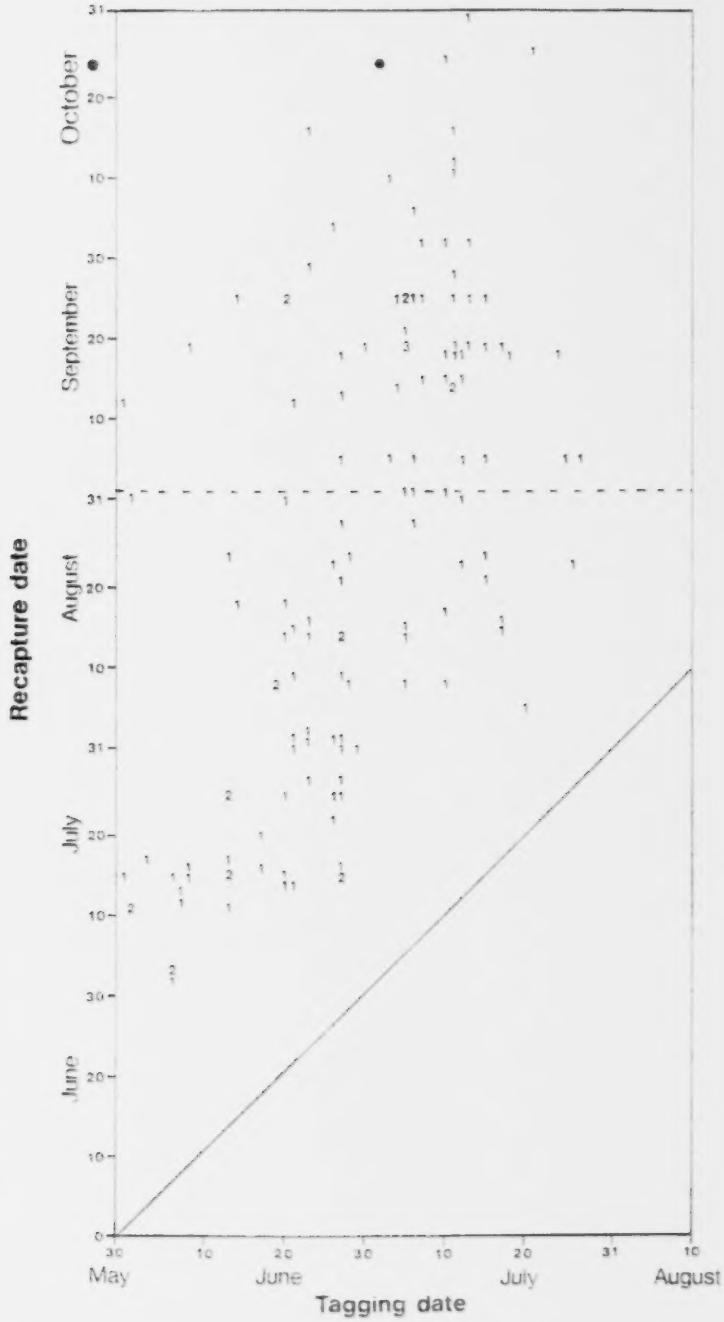

FIG. 5. Days from tagging to recapture of wild salmon before and after September 1 at Mactaquac in 1972.

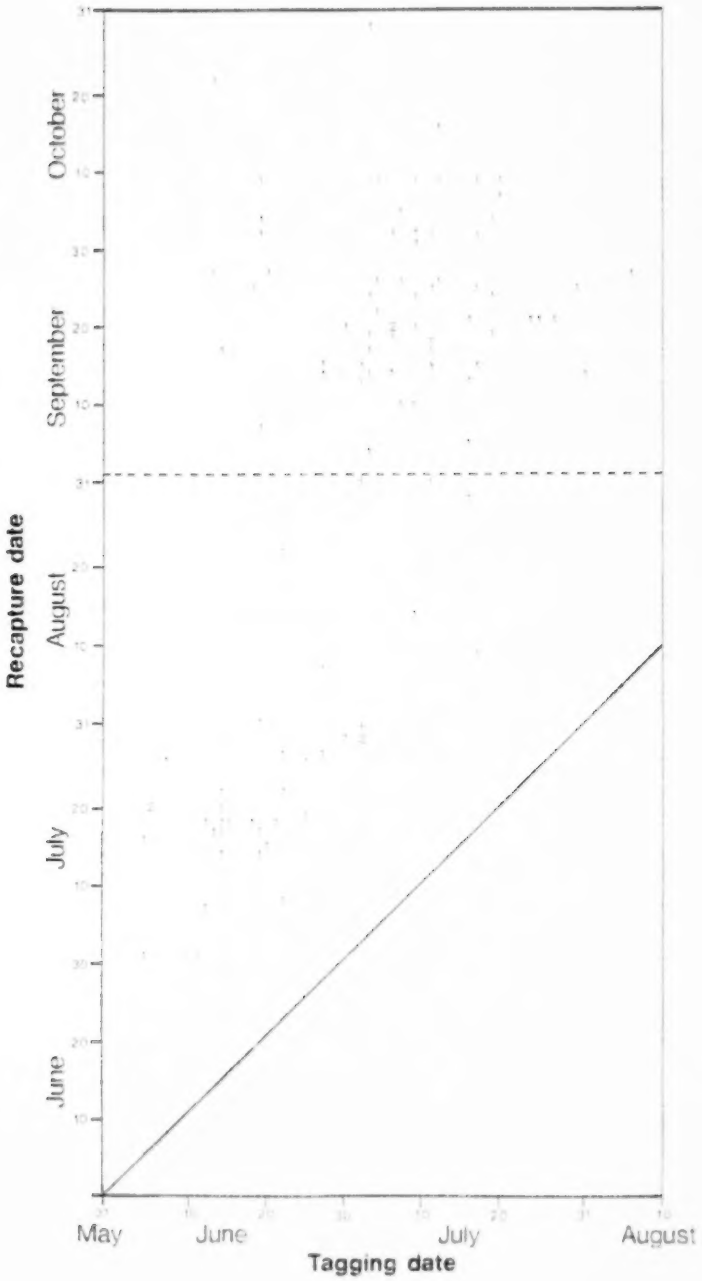

FIG. 6. Days from tagging to recapture of wild salmon before and after September 1 at Mactaquac in 1973.